Pitfalls in Pneumonia Patients

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Disclosures

• No financial or professional conflicts of interest

Objectives

• Community-Acquired Pneumonia (CAP)
• Why Performance Measures?
• Diagnosis
  • Who’s included in:
    • The management guidelines’?
    • The core measures?
• Optimizing Care & Meeting Core Measures
  • Etiologic testing
  • Antibiotic timing
  • Antibiotic selection

*IDSA/ATS Guidelines 2007
We Won’t Cover…

• Disposition Decision
• Outpatient Management
• Healthcare-Associated Pneumonia (HCAP)
• Hospital-Acquired Pneumonia (HAP)
• Ventilator-Associated Pneumonia (VAP)
• "Non-ED" Pneumonia Core Measures
  • PN-1: assessment of oxygenation status
  • PN-2: pneumococcal vaccination
  • PN-4: adult smoking cessation advice
  • PN-7: influenza vaccination

ATS/IDSA Guidelines 2005

The Old Man’s Friend
(And Now the Ire of Many an ED QI Director)

• #1 ED admitting diagnosis
• 7th leading cause of death
• Mortality unchanged since PCN
• $8.4-10 billion/year
• Public reporting of performance measures

Why Pneumonia Performance Measures?

• Perceived outcome variations
• Outcome measurement problematic
  • Data collection burden
  • Case-mix adjustment
  • Need for post-hospitalization follow-up
• Process measures as surrogates for quality markers
2007 IDSA/ATS Guidelines

IDSA/ATS Guidelines
Do Not Apply To…

- Immunocompromised
  – Transplant recipients
  – Chemotherapy or long-term (>30 days) high-dose corticosteroids
  – Congenital/acquired immunodeficiency
  – HIV with CD4 < 350

- Children < 18 years old

Diagnosis of CAP

Suggestive Clinical Features*
(cough, fever, sputum, pleuritic chest pain)

Demonstrable Infiltrate by CXR
(CT more sensitive, ? significance with negative CXR)

Physical exam: less sensitive-specific than CXR

*Clinical features and exam may be lacking in altered/elderly patients

Moderate/III
Who’s Included in the Core Measures?

- Hospital discharges with
  - ICD-9 principal diagnosis code of pneumonia
  - OR -
  - Principal diagnosis of sepsis or respiratory failure AND other diagnosis code of pneumonia

Who’s Excluded from the Core Measures?

- Age < 18
- Transfer from another ED
- On antibiotics within prior 24 hours
- No final ED pneumonia diagnosis
- Comfort measures only
- No radiographic evidence of pneumonia
Final ED Diagnosis of Pneumonia?

<table>
<thead>
<tr>
<th>These Count (Beware...)</th>
<th>These Don't</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infiltrate</td>
<td>Aspiration pneumonia (??)</td>
</tr>
<tr>
<td>Lower respiratory infection</td>
<td>Chronic infiltrate</td>
</tr>
<tr>
<td>Need to evaluate for...</td>
<td>Doubt pneumonia</td>
</tr>
<tr>
<td>Admission pneumonia pathway (or equivalent)</td>
<td>Pneumonia caused by chemical agents or aerosolized meds</td>
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<tr>
<td>Pneumonitis (??)</td>
<td>Respiratory problems without mention of pneumonia</td>
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<tr>
<td>Possible, probable, questionable, rule out, suspected...</td>
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“Diagnostic Uncertainty”

- Provider must document both:
  1. Initial clinical picture unclear **AND**
  2. Resulted in **diagnostic** delay
    - Not in antibiotic delay

Do you obtain blood cultures for routine hospitalized CAP?

A. Yes
B. No
C. Sometimes
D. I do now (thanks to the core measures)
### Most Common CAP Etiologies

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### Etiologies Covered With Empiric Antibiotics

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*Influenza A/B, adenovirus, RSV, parainfluenza

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*Influenza A/B, adenovirus, RSV, parainfluenza
Etiologic Testing

Recommended* ONLY
IF
Results would alter standard management
AND
Suspected by clinical/epidemiologic clues

*Optional for outpatients with CAP
Moderate/III

Risk Factors for Specific Pathogens

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<tr>
<th>Condition (Epidemiology)</th>
<th>Pathogen</th>
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<tr>
<td>Alcoholism</td>
<td>S. pneumoniae, oral anaerobes, K. pneumoniae, Acinetobacter spp, TB</td>
</tr>
<tr>
<td>COPD +/- smoking</td>
<td>H. influenzae, P. aeruginosa, Legionella, S. pneumoniae, L. pneumophila, M. catarrhalis</td>
</tr>
<tr>
<td>Aspiration</td>
<td>Gram-negative enteric pathogens, oral anaerobes</td>
</tr>
<tr>
<td>Lung abscess</td>
<td>CA-MRSA, oral anaerobes, endemic fungal pneumonia, TB, atypical mycobacteria</td>
</tr>
<tr>
<td>Exposure to bat or bird droppings</td>
<td>Histoplasma capsulatum</td>
</tr>
<tr>
<td>Exposure to birds</td>
<td>Chlamydophila psittaci (if poultry: avian influenza)</td>
</tr>
<tr>
<td>Exposure to rabbits</td>
<td>Francisella tularensis (Q fever)</td>
</tr>
<tr>
<td>Exposure to farm animals or parturient cats</td>
<td>Coxiella burnetti</td>
</tr>
<tr>
<td>HIV infection (early)</td>
<td>S. pneumoniae, H. influenzae, TB</td>
</tr>
<tr>
<td>HIV infection (late)</td>
<td>Above + Pneumocystis jirovecii, Cryptococcus, Histoplasma, Atypical mycobacteria, P. aeruginosa, H. influenzae</td>
</tr>
<tr>
<td>Hotel/cruise ship within 2 weeks</td>
<td>Legionella spp</td>
</tr>
<tr>
<td>Travel to/residence in SW US</td>
<td>Coccidioides spp, Hantavirus</td>
</tr>
<tr>
<td>Travel to/residence in SE/E Asia</td>
<td>Burkholderia pseudomallei, avian influenza, SARS</td>
</tr>
<tr>
<td>Influenza active in community</td>
<td>Influenza, S. pneumoniae, S. aureus, H. influenzae</td>
</tr>
<tr>
<td>Structural lung defect (bronchiectasis)</td>
<td>P. aeruginosa, Burkholderia cepacia, S. aureus</td>
</tr>
<tr>
<td>Chronic obstructive lung disease</td>
<td>S. pneumoniae, S. aureus, H. influenzae</td>
</tr>
<tr>
<td>Aspiration</td>
<td>Anaerobes, S. pneumoniae, H. influenzae, S. aureus</td>
</tr>
<tr>
<td>Endobronchial obstruction</td>
<td>Anaerobes, S. pneumoniae, H. influenzae, S. aureus</td>
</tr>
<tr>
<td>Injection drug use</td>
<td>S. aureus, anaerobes, TB, S. pneumoniae</td>
</tr>
<tr>
<td>Bioterrorism</td>
<td>B. anthracis (anthrax), Yersinia pestis (plague), Francisella tularensis (tularemia)</td>
</tr>
</tbody>
</table>

Blood Cultures

- True positives 5-14%
  - Most commonly S. pneumoniae
  - Negligible impact on management
- False positives
  - Prolonged hospital stays
  - Increased $$$
  - More vancomycin use
Blood Cultures
Recommended For

- ICU admissions
- Cavitary lesions
- Leukopenia
- Alcohol abuse
- Chronic severe liver disease
- Asplenia (anatomic/functional)
- Pleural effusion

IDSA/ATS 2007

Etiologic Testing

Targeted Testing

<table>
<thead>
<tr>
<th>Indication (Clinical)</th>
<th>Blood Culture</th>
<th>Sputum Culture</th>
<th>Legionella UAT</th>
<th>Pneumococcal UAT</th>
<th>Other</th>
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<tr>
<td>ICU Admission</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Culture of Inpatient Therapy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Cavitary lesions</td>
<td>X</td>
<td></td>
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<tr>
<td>Pneumococcal UAT</td>
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<td>Other</td>
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The Bottom Line...

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Blood Culture Core Measures

• PN-3a: within 24 hrs for ICU admits
  – Consistent with IDSA/ATS
  – Severity of illness/prognostic scoring to predict
• PN-3b: prior to antibiotics (in ED)
  – Often misunderstood
  – Does not mandate blood cultures for all CAP admissions
  – If obtained, do before antibiotics

The Culture Wars

• The UCSF experience
  1. ED MD: blood cultures not indicated
  2. Antibiotics administered
  3. Admit team: orders blood cultures
  4. ED labeled as giving antibiotics prior to obtaining blood cultures (!@%#*)

Time to First Antibiotic Dose (PN-5c)

• 1997
  – TFAD ≤8 hrs: lower 30d mortality
• 2004
  – TFAD ≤4 hrs:
    • reduced in-hospital mortality (6.8 vs 7.4%)
    • reduced 30d mortality (11.6 vs 12.7%)
    • decreased length of stay
Emergency Medicine

Time to First Antibiotic Dose (PN-5c)

<table>
<thead>
<tr>
<th>Year</th>
<th>Organization</th>
<th>TFAD (hrs)</th>
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<tbody>
<tr>
<td>1997</td>
<td>Medicare National Pneumonia Project (MNPP)</td>
<td>≤8</td>
</tr>
<tr>
<td>2002</td>
<td>MNPP</td>
<td>≤4</td>
</tr>
<tr>
<td>2002</td>
<td>TJC/CMS</td>
<td>≤4</td>
</tr>
<tr>
<td>2003</td>
<td>IDSA</td>
<td>≤4</td>
</tr>
<tr>
<td>2007</td>
<td>TJC/CMS</td>
<td>≤6</td>
</tr>
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The Bottom Line

Time to First Antibiotic Dose (PN-5c)

- “For patients admitted through the ED, the first antibiotic dose should be administered while still in the ED”
**Emergency Medicine**

**Antibiotic Selection (PN-6)**

**Inpatient (non-ICU)**

- Respiratory quinolone (Strong/I)
- $\beta$-lactam* + macrolide (Strong/I)
- Doxycycline as alternative to macrolide (III)
- Respiratory quinolone alone if PCN allergic

*cefotaxime, ceftriaxone, ampicillin, ertapenem

**The Bottom Line (at UCSF)**…
- Ceftriaxone + Doxycycline
- Levofloxacin if PCN allergic

---

**Antibiotic Selection (PN-6b)**

**Inpatient (ICU)**

- $\beta$-lactam* + azithromycin (II) or fluoroquinolone (I)
  - (Strong)
- *cefotaxime, ceftriaxone, ampicillin-sulbactam
- PCN allergic: fluoroquinolone + aztreonam

**The Bottom Line (at UCSF)**…
- Ceftriaxone + Azithromycin (IV)
- Levofloxacin if PCN allergy
**Antibiotic Therapy (PN-6a)**

**Inpatient (ICU)**

**Special Considerations**

### Pseudomonas

- **Antipneumococcal, antipseudomonal β-lactam**
  - A. ciprofloxacin or levofloxacin (750 mg)
  - or
  - B. aminoglycoside & azithromycin
  - or
  - C. aminoglycoside & antipneumococcal fluoroquinolone
  - (Moderate/III)

### CA-MRSA

- Add vancomycin or linezolid (Moderate/III)

**Pseudomonas risk factors:** COPD, late HIV, structural lung dz

**The Bottom Line…**

Pseudomonal risks are only indication for Piperacillin/Tazobactam!!!

---

**Core Measures Compliance**

**Common Pitfalls**

- CAP as final ED diagnosis, no antibiotics
- CT r/o PE finds CAP, antibiotics delayed
- “Possible”, “infiltrate”, “consolidation”, “rule out” in final ED diagnosis
- Delay from antibiotic order to administration
- Piperacillin/tazobactam!!!

---

**Take Home Points**

- Targeted blood cultures only
- Antibiotic selection trumps timing
- Beware the common pitfalls
  - Not giving antibiotics
  - Euphemisms
  - Antibiotics ordered, admin delayed
  - Refer to antibiotic guidelines for selection
  - “Diagnostic uncertainty”
- Do the right thing for your patients!!!
Questions?

Do you order sputum Gram stain & culture for CAP?

Sputum Gram Stain & Cultures

- Yield = highly variable
  - Specimen collection (40%)
  - Transport
  - Rapid processing
  - Cytologic criteria
  - Absence of prior antibiotic therapy
  - Skill in interpretation
- 14% with predominant morphotype on Gram stain
Sputum Gram Stain & Cultures
Recommended For:
- ICU admission
- Failure of outpatient antibiotic therapy
- Cavitary lesion
- Active alcohol abuse
- Severe obstructive/structural lung disease
- Pleural effusion

Do you order urinary antigen testing for CAP?

Etiologic Testing
Urinary Antigen Testing
- Pneumococcal UAT
  - Rapid (15 mins)
  - Sens 50-80%, Spec >90%
  - Remains + after antibiotics initiated
  - $30 per specimen
**Etiologic Testing**

**Urinary Antigen Testing**

- *Legionella* serotype 1 UAT
  - Causative serotype in 80-95%
  - Sens 70-90%, Spec 99%
  - + on day 1, remains + for weeks

**Antibiotic Therapy**

**Outpatient**

- Previously healthy and no risk factors for DRSP* infection
  - A. Macrolide (Strong/I)
  - B. Doxycycline (Weak/III)

- Presence of comorbidities or risks for DRSP*
  - A. Respiratory quinolone (Strong/I)
  - B. β-lactam* + macrolide (Strong/I)

- Doxycycline instead of macrolide (II)

- Region with >25% macrolide-resistant S. pneumoniae
  - Consider alternate agents in previously healthy pts

DRSP = drug resistant S. pneumoniae
Risks for DRSP = age <2 or >65 yrs, β-lactam therapy < 3 months*, alcoholism, medical comorbidities, immunosuppressive illness or therapy, exposure to child in daycare

**HCAP**

- Includes
  - Hospitalized ≥ 2 days within 90 days
  - SNF or long-term care facility
  - IV antibiotic therapy, chemotherapy, or wound care within 30 days
  - Hospital or hemodialysis clinic within 30 days
- Increased risk for multi-drug resistant pathogens

*HCAP = hospital acquired pneumonia
### Etiology

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